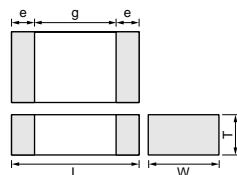


## Monolithic Ceramic Capacitors GR\_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

High Dielectric Constant Type 6.3/16/25/50V



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
<b>GRM155</b>	1.0 $\pm$ 0.05	0.5 $\pm$ 0.05	0.5 $\pm$ 0.05	0.15 to 0.3	0.4
<b>GRM188*</b>	1.6 $\pm$ 0.1	0.8 $\pm$ 0.1	0.8 $\pm$ 0.1	0.2 to 0.5	0.5
<b>GRM216</b>			0.6 $\pm$ 0.1		
<b>GRM219</b>			0.85 $\pm$ 0.1		
<b>GRM21A</b>			1.0 $\pm$ 0/-0.2	0.2 to 0.7	0.7
<b>GRM21B</b>			1.25 $\pm$ 0.1		
<b>GRM316</b>			0.6 $\pm$ 0.1		
<b>GRM319</b>	3.2 $\pm$ 0.15	1.6 $\pm$ 0.15	0.85 $\pm$ 0.1		
<b>GRM31M</b>			1.15 $\pm$ 0.1	0.3 to 0.8	1.5
<b>GRM31C</b>	3.2 $\pm$ 0.2	1.6 $\pm$ 0.2	1.6 $\pm$ 0.2		

\* Bulk Case : 1.6  $\pm$ 0.07(L)  $\times$  0.8  $\pm$ 0.07(W)  $\times$  0.8  $\pm$ 0.07(T)

Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
<b>GRM033R61A152KA01</b>	X5R (EIA)	10	1500pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R61A222KA01</b>	X5R (EIA)	10	2200pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R61A332KA01</b>	X5R (EIA)	10	3300pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R61A472KA01</b>	X5R (EIA)	10	4700pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R61A682KA01</b>	X5R (EIA)	10	6800pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R61A103KA01</b>	X5R (EIA)	10	10000pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM155R61C104KA88</b>	X5R (EIA)	16	0.10 $\mu$ F $\pm$ 10%	1.00	0.50	0.50
<b>GRM155R61A683KA01</b>	X5R (EIA)	10	68000pF $\pm$ 10%	1.00	0.50	0.50
<b>GRM155R61A104KA01</b>	X5R (EIA)	10	0.10 $\mu$ F $\pm$ 10%	1.00	0.50	0.50
<b>GRM188R61E224KA88</b>	X5R (EIA)	25	0.22 $\mu$ F $\pm$ 10%	1.60	0.80	0.80
<b>GRM188R61A334KA61</b>	X5R (EIA)	10	0.33 $\mu$ F $\pm$ 10%	1.60	0.80	0.80
<b>GRM188R61A474KA61</b>	X5R (EIA)	10	0.47 $\mu$ F $\pm$ 10%	1.60	0.80	0.80
<b>GRM188R61A684KA61</b>	X5R (EIA)	10	0.68 $\mu$ F $\pm$ 10%	1.60	0.80	0.80
<b>GRM188R61A105KA61</b>	X5R (EIA)	10	1.0 $\mu$ F $\pm$ 10%	1.60	0.80	0.80
<b>GRM188R60J105KA01</b>	X5R (EIA)	6.3	1.0 $\mu$ F $\pm$ 10%	1.60	0.80	0.80
<b>GRM219R61A105KC01</b>	X5R (EIA)	10	1.0 $\mu$ F $\pm$ 10%	2.00	1.25	0.85
<b>GRM219R60J155KC01</b>	X5R (EIA)	6.3	1.5 $\mu$ F $\pm$ 10%	2.00	1.25	0.85
<b>GRM21BR61A225KA01</b>	X5R (EIA)	10	2.2 $\mu$ F $\pm$ 10%	2.00	1.25	1.25
<b>GRM21BR60J225KA01</b>	X5R (EIA)	6.3	2.2 $\mu$ F $\pm$ 10%	2.00	1.25	1.25
<b>GRM21BR60J335KA11</b>	X5R (EIA)	6.3	3.3 $\mu$ F $\pm$ 10%	2.00	1.25	1.25
<b>GRM21BR60J475KA11</b>	X5R (EIA)	6.3	4.7 $\mu$ F $\pm$ 10%	2.00	1.25	1.25
<b>GRM319R61A225KC01</b>	X5R (EIA)	10	2.2 $\mu$ F $\pm$ 10%	3.20	1.60	0.85
<b>GRM31CR61A475KA01</b>	X5R (EIA)	10	4.7 $\mu$ F $\pm$ 10%	3.20	1.60	1.60
<b>GRM31CR61A106KA01</b>	X5R (EIA)	10	10 $\mu$ F $\pm$ 10%	3.20	1.60	1.60
<b>GRM31CR60J106KA01</b>	X5R (EIA)	6.3	10 $\mu$ F $\pm$ 10%	3.20	1.60	1.60
<b>GRM31MR60J475KC11</b>	X5R (EIA)	6.3	4.7 $\mu$ F $\pm$ 10%	3.20	1.60	1.15
<b>GRM31XR61A335KC12</b>	X5R (EIA)	10	3.3 $\mu$ F $\pm$ 10%	3.20	1.60	1.30
<b>GRM32ER61A106KC01</b>	X5R (EIA)	10	10 $\mu$ F $\pm$ 10%	3.20	2.50	2.50
<b>GRM55DR61H106KA88</b>	X5R (EIA)	50	10 $\mu$ F $\pm$ 10%	5.70	5.00	2.00
<b>GRM033R71C101KD01</b>	X7R (EIA)	16	100pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R71C151KD01</b>	X7R (EIA)	16	150pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R71C221KD01</b>	X7R (EIA)	16	220pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R71C331KD01</b>	X7R (EIA)	16	330pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R71C471KD01</b>	X7R (EIA)	16	470pF $\pm$ 10%	0.6	0.3	0.3
<b>GRM033R71C681KD01</b>	X7R (EIA)	16	680pF $\pm$ 10%	0.6	0.3	0.3

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Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM033R71C102KD01	X7R (EIA)	16	1000pF ±10%	0.6	0.3	0.3
GRM033R70J152KA01	X7R (EIA)	6.3	1500pF ±10%	0.6	0.3	0.3
GRM033R70J222KA01	X7R (EIA)	6.3	2200pF ±10%	0.6	0.3	0.3
GRM033R70J332KA01	X7R (EIA)	6.3	3300pF ±10%	0.6	0.3	0.3
GRM033R70J472KA01	X7R (EIA)	6.3	4700pF ±10%	0.6	0.3	0.3
GRM033R70J682KA01	X7R (EIA)	6.3	6800pF ±10%	0.6	0.3	0.3
GRM033R70J103KA01	X7R (EIA)	6.3	10000pF ±10%	0.6	0.3	0.3
GRM155R71H221KA01	X7R (EIA)	50	220pF ±10%	1.00	0.50	0.50
GRM155R71H331KA01	X7R (EIA)	50	330pF ±10%	1.00	0.50	0.50
GRM155R71H471KA01	X7R (EIA)	50	470pF ±10%	1.00	0.50	0.50
GRM155R71H681KA01	X7R (EIA)	50	680pF ±10%	1.00	0.50	0.50
GRM155R71H102KA01	X7R (EIA)	50	1000pF ±10%	1.00	0.50	0.50
GRM155R71H152KA01	X7R (EIA)	50	1500pF ±10%	1.00	0.50	0.50
GRM155R71H222KA01	X7R (EIA)	50	2200pF ±10%	1.00	0.50	0.50
GRM155R71H332KA01	X7R (EIA)	50	3300pF ±10%	1.00	0.50	0.50
GRM155R71H472KA01	X7R (EIA)	50	4700pF ±10%	1.00	0.50	0.50
GRM155R71E682KA01	X7R (EIA)	25	6800pF ±10%	1.00	0.50	0.50
GRM155R71E103KA01	X7R (EIA)	25	10000pF ±10%	1.00	0.50	0.50
GRM155R71E153KA61	X7R (EIA)	25	15000pF ±10%	1.00	0.50	0.50
GRM155R71E223KA61	X7R (EIA)	25	22000pF ±10%	1.00	0.50	0.50
GRM155R71C153KA01	X7R (EIA)	16	15000pF ±10%	1.00	0.50	0.50
GRM155R71C223KA01	X7R (EIA)	16	22000pF ±10%	1.00	0.50	0.50
GRM155R71C104KA88	X7R (EIA)	16	0.10μF ±10%	1.00	0.50	0.50
GRM155R71A333KA01	X7R (EIA)	10	33000pF ±10%	1.00	0.50	0.50
GRM155R71A473KA01	X7R (EIA)	10	47000pF ±10%	1.00	0.50	0.50
GRM155R71A104KA01	X7R (EIA)	10	0.10μF ±10%	1.00	0.50	0.50
GRM188R71H221KA01	X7R (EIA)	50	220pF ±10%	1.60	0.80	0.80
GRM188R71H331KA01	X7R (EIA)	50	330pF ±10%	1.60	0.80	0.80
GRM188R71H471KA01	X7R (EIA)	50	470pF ±10%	1.60	0.80	0.80
GRM188R71H681KA01	X7R (EIA)	50	680pF ±10%	1.60	0.80	0.80
GRM188R71H102KA01	X7R (EIA)	50	1000pF ±10%	1.60	0.80	0.80
GRM188R71H152KA01	X7R (EIA)	50	1500pF ±10%	1.60	0.80	0.80
GRM188R71H222KA01	X7R (EIA)	50	2200pF ±10%	1.60	0.80	0.80
GRM188R71H332KA01	X7R (EIA)	50	3300pF ±10%	1.60	0.80	0.80
GRM188R71H472KA01	X7R (EIA)	50	4700pF ±10%	1.60	0.80	0.80
GRM188R71H682KA01	X7R (EIA)	50	6800pF ±10%	1.60	0.80	0.80
GRM188R71H103KA01	X7R (EIA)	50	10000pF ±10%	1.60	0.80	0.80
GRM188R71H153KA01	X7R (EIA)	50	15000pF ±10%	1.60	0.80	0.80
GRM188R71H223KA01	X7R (EIA)	50	22000pF ±10%	1.60	0.80	0.80
GRM188R71H333KA61	X7R (EIA)	50	33000pF ±10%	1.60	0.80	0.80
GRM188R71H473KA61	X7R (EIA)	50	47000pF ±10%	1.60	0.80	0.80
GRM188R71H683KA93	X7R (EIA)	50	68000pF ±10%	1.60	0.80	0.80
GRM188R71H104KA93	X7R (EIA)	50	0.10μF ±10%	1.60	0.80	0.80
GRM188R71E333KA01	X7R (EIA)	25	33000pF ±10%	1.60	0.80	0.80
GRM188R71E473KA01	X7R (EIA)	25	47000pF ±10%	1.60	0.80	0.80
GRM188R71E683KA01	X7R (EIA)	25	68000pF ±10%	1.60	0.80	0.80
GRM188R71E104KA01	X7R (EIA)	25	0.10μF ±10%	1.60	0.80	0.80
GRM188R71E154KA01	X7R (EIA)	25	0.15μF ±10%	1.60	0.80	0.80
GRM188R71C104KA01	X7R (EIA)	16	0.10μF ±10%	1.60	0.80	0.80
GRM188R71C224KA01	X7R (EIA)	16	0.22μF ±10%	1.60	0.80	0.80
GRM188R71A154KA01	X7R (EIA)	10	0.15μF ±10%	1.60	0.80	0.80
GRM188R71A224KA01	X7R (EIA)	10	0.22μF ±10%	1.60	0.80	0.80
GRM219R71H333KA01	X7R (EIA)	50	33000pF ±10%	2.00	1.25	0.85
GRM219R71H334KA88	X7R (EIA)	50	0.33μF ±10%	2.00	1.25	0.85
GRM219R71E224KC01	X7R (EIA)	25	0.22μF ±10%	2.00	1.25	0.85

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Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM219R71C474KA01	X7R (EIA)	16	0.47μF ±10%	2.00	1.25	0.85
GRM219R71C684KC01	X7R (EIA)	16	0.68μF ±10%	2.00	1.25	0.85
GRM21BR71H473KA01	X7R (EIA)	50	47000pF ±10%	2.00	1.25	1.25
GRM21BR71H683KA01	X7R (EIA)	50	68000pF ±10%	2.00	1.25	1.25
GRM21BR71H104KA01	X7R (EIA)	50	0.10μF ±10%	2.00	1.25	1.25
GRM21BR71H154KA01	X7R (EIA)	50	0.15μF ±10%	2.00	1.25	1.25
GRM21BR71H224KA01	X7R (EIA)	50	0.22μF ±10%	2.00	1.25	1.25
GRM21BR71H474KA88	X7R (EIA)	50	0.47μF ±10%	2.00	1.25	1.25
GRM21BR71E104KA01	X7R (EIA)	25	0.10μF ±10%	2.00	1.25	1.25
GRM21BR71E154KA01	X7R (EIA)	25	0.15μF ±10%	2.00	1.25	1.25
GRM21BR71E334KC01	X7R (EIA)	25	0.33μF ±10%	2.00	1.25	1.25
GRM21BR71E474KA01	X7R (EIA)	25	0.47μF ±10%	2.00	1.25	1.25
GRM21BR71E105KA99	X7R (EIA)	25	1.0μF ±10%	2.00	1.25	1.25
GRM21BR71C105KA01	X7R (EIA)	16	1.0μF ±10%	2.00	1.25	1.25
GRM319R71H334KA01	X7R (EIA)	50	0.33μF ±10%	3.20	1.60	0.85
GRM319R71E684KC01	X7R (EIA)	25	0.68μF ±10%	3.20	1.60	0.85
GRM319R71C105KC11	X7R (EIA)	16	1.0μF ±10%	3.20	1.60	0.85
GRM319R71A105KC01	X7R (EIA)	10	1.0μF ±10%	3.20	1.60	0.85
GRM31CR71H155KA88	X7R (EIA)	50	1.5μF ±10%	3.20	1.60	1.60
GRM31CR71H225KA88	X7R (EIA)	50	2.2μF ±10%	3.20	1.60	1.60
GRM31CR71E335KA88	X7R (EIA)	25	3.3μF ±10%	3.20	1.60	1.60
GRM31CR71E475KA88	X7R (EIA)	25	4.7μF ±10%	3.20	1.60	1.60
GRM31CR71C475KA01	X7R (EIA)	16	4.7μF ±10%	3.20	1.60	1.60
GRM31CR71A106KA01	X7R (EIA)	10	10μF ±10%	3.20	1.60	1.60
GRM31MR71H474KA01	X7R (EIA)	50	0.47μF ±10%	3.20	1.60	1.15
GRM31MR71H105KA88	X7R (EIA)	50	1.0μF ±10%	3.20	1.60	1.15
GRM31MR71E105KA01	X7R (EIA)	25	1.0μF ±10%	3.20	1.60	1.15
GRM31MR71E225KA93	X7R (EIA)	25	2.2μF ±10%	3.20	1.60	1.15
GRM31MR71C155KC11	X7R (EIA)	16	1.5μF ±10%	3.20	1.60	1.15
GRM31MR71C225KA35	X7R (EIA)	16	2.2μF ±10%	3.20	1.60	1.15
GRM31MR71A225KA01	X7R (EIA)	10	2.2μF ±10%	3.20	1.60	1.15
GRM32DR71C106KA01	X7R (EIA)	16	10μF ±10%	3.20	2.50	2.00
GRM32ER71H475KA88	X7R (EIA)	50	4.7μF ±10%	3.20	2.50	2.50
GRM32MR71C225KC01	X7R (EIA)	16	2.2μF ±10%	3.20	2.50	1.15
GRM32NR71H684KA01	X7R (EIA)	50	0.68μF ±10%	3.20	2.50	1.35
GRM32NR71C335KC01	X7R (EIA)	16	3.3μF ±10%	3.20	2.50	1.35
GRM32RR71H105KA01	X7R (EIA)	50	1.0μF ±10%	3.20	2.50	1.80
GRM32RR71E225KC01	X7R (EIA)	25	2.2μF ±10%	3.20	2.50	1.80
GRM32RR71C475KC01	X7R (EIA)	16	4.7μF ±10%	3.20	2.50	1.80
GRM43ER71H225KA01	X7R (EIA)	50	2.2μF ±10%	4.50	3.20	2.50
GRM43ER71E475KA01	X7R (EIA)	25	4.7μF ±10%	4.50	3.20	2.50
GRM55ER71H475KA01	X7R (EIA)	50	4.7μF ±10%	5.70	5.00	2.50
GRM55RR71H105KA01	X7R (EIA)	50	1.0μF ±10%	5.70	5.00	1.80
GRM55RR71H155KA01	X7R (EIA)	50	1.5μF ±10%	5.70	5.00	1.80
GRM033F51A222ZD01	Y5V (EIA)	10	2200pF +80/-20%	0.6	0.3	0.3
GRM033F51A472ZD01	Y5V (EIA)	10	4700pF +80/-20%	0.6	0.3	0.3
GRM033F51A103ZD01	Y5V (EIA)	10	10000pF +80/-20%	0.6	0.3	0.3
GRM155F51H222ZA01	Y5V (EIA)	50	2200pF +80/-20%	1.00	0.50	0.50
GRM155F51H472ZA01	Y5V (EIA)	50	4700pF +80/-20%	1.00	0.50	0.50
GRM155F51H103ZA01	Y5V (EIA)	50	10000pF +80/-20%	1.00	0.50	0.50
GRM155F51E223ZA01	Y5V (EIA)	25	22000pF +80/-20%	1.00	0.50	0.50
GRM155F51E473ZA01	Y5V (EIA)	25	47000pF +80/-20%	1.00	0.50	0.50
GRM155F51E104ZA01	Y5V (EIA)	25	0.10μF +80/-20%	1.00	0.50	0.50
GRM155F51C473ZA01	Y5V (EIA)	16	47000pF +80/-20%	1.00	0.50	0.50
GRM155F51C104ZA01	Y5V (EIA)	16	0.10μF +80/-20%	1.00	0.50	0.50

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GRM188F51H103ZA01	Y5V (EIA)	50	10000pF +80/-20%	1.60	0.80	0.80
GRM188F51H223ZA01	Y5V (EIA)	50	22000pF +80/-20%	1.60	0.80	0.80
GRM188F51H473ZA01	Y5V (EIA)	50	47000pF +80/-20%	1.60	0.80	0.80
GRM188F51H104ZA01	Y5V (EIA)	50	0.10μF +80/-20%	1.60	0.80	0.80
GRM188F51H224ZA01	Y5V (EIA)	50	0.22μF +80/-20%	1.60	0.80	0.80
GRM188F51E104ZA01	Y5V (EIA)	25	0.10μF +80/-20%	1.60	0.80	0.80
GRM188F51E474ZA01	Y5V (EIA)	25	0.47μF +80/-20%	1.60	0.80	0.80
GRM188F51C224ZA01	Y5V (EIA)	16	0.22μF +80/-20%	1.60	0.80	0.80
GRM188F51C474ZA01	Y5V (EIA)	16	0.47μF +80/-20%	1.60	0.80	0.80
GRM188F51C105ZA01	Y5V (EIA)	16	1.0μF +80/-20%	1.60	0.80	0.80
GRM188F51A474ZA01	Y5V (EIA)	10	0.47μF +80/-20%	1.60	0.80	0.80
GRM188F51A105ZA01	Y5V (EIA)	10	1.0μF +80/-20%	1.60	0.80	0.80
GRM216F51H224ZA01	Y5V (EIA)	50	0.22μF +80/-20%	2.00	1.25	0.60
GRM216F51E474ZA01	Y5V (EIA)	25	0.47μF +80/-20%	2.00	1.25	0.60
GRM219F51H104ZA01	Y5V (EIA)	50	0.10μF +80/-20%	2.00	1.25	0.85
GRM219F51H474ZA01	Y5V (EIA)	50	0.47μF +80/-20%	2.00	1.25	0.85
GRM219F51H105ZA01	Y5V (EIA)	50	1.0μF +80/-20%	2.00	1.25	0.85
GRM219F51E224ZA01	Y5V (EIA)	25	0.22μF +80/-20%	2.00	1.25	0.85
GRM219F51E105ZA01	Y5V (EIA)	25	1.0μF +80/-20%	2.00	1.25	0.85
GRM219F51C105ZA01	Y5V (EIA)	16	1.0μF +80/-20%	2.00	1.25	0.85
GRM219F51A105ZA01	Y5V (EIA)	10	1.0μF +80/-20%	2.00	1.25	0.85
GRM21BF51H224ZA01	Y5V (EIA)	50	0.22μF +80/-20%	2.00	1.25	1.25
GRM21BF51E474ZA01	Y5V (EIA)	25	0.47μF +80/-20%	2.00	1.25	1.25
GRM21BF51E225ZA01	Y5V (EIA)	25	2.2μF +80/-20%	2.00	1.25	1.25
GRM21BF51C225ZA01	Y5V (EIA)	16	2.2μF +80/-20%	2.00	1.25	1.25
GRM21BF51A225ZA01	Y5V (EIA)	10	2.2μF +80/-20%	2.00	1.25	1.25
GRM21BF51A475ZA01	Y5V (EIA)	10	4.7μF +80/-20%	2.00	1.25	1.25
GRM319F51C105ZA01	Y5V (EIA)	16	1.0μF +80/-20%	3.20	1.60	0.85
GRM319F51A225ZA01	Y5V (EIA)	10	2.2μF +80/-20%	3.20	1.60	0.85
GRM31CF51H475ZA01	Y5V (EIA)	50	4.7μF +80/-20%	3.20	1.60	1.60
GRM31CF51E106ZA01	Y5V (EIA)	25	10μF +80/-20%	3.20	1.60	1.60
GRM31MF51H474ZA01	Y5V (EIA)	50	0.47μF +80/-20%	3.20	1.60	1.15
GRM31MF51E105ZA01	Y5V (EIA)	25	1.0μF +80/-20%	3.20	1.60	1.15
GRM31MF51E475ZA01	Y5V (EIA)	25	4.7μF +80/-20%	3.20	1.60	1.15
GRM31MF51C225ZA01	Y5V (EIA)	16	2.2μF +80/-20%	3.20	1.60	1.15
GRM31MF51C475ZA01	Y5V (EIA)	16	4.7μF +80/-20%	3.20	1.60	1.15
GRM31MF51A475ZA01	Y5V (EIA)	10	4.7μF +80/-20%	3.20	1.60	1.15
GRM31MF51A106ZA01	Y5V (EIA)	10	10μF +80/-20%	3.20	1.60	1.15
GRM31MF50J106ZA01	Y5V (EIA)	6.3	10μF +80/-20%	3.20	1.60	1.15
GRM329F51E475ZA01	Y5V (EIA)	25	4.7μF +80/-20%	3.20	2.50	0.85
GRM32DF51H106ZA01	Y5V (EIA)	50	10μF +80/-20%	3.20	2.50	2.00
GRM32NF51E106ZA01	Y5V (EIA)	25	10μF +80/-20%	3.20	2.50	1.35
GRM32NF51C106ZA01	Y5V (EIA)	16	10μF +80/-20%	3.20	2.50	1.35
GRM32RF51H105ZA01	Y5V (EIA)	50	1.0μF +80/-20%	3.20	2.50	1.8
GRM188E41H103MA01	Z5U (EIA)	50	10000pF ±20%	1.60	0.80	0.80
GRM188E41H223MA01	Z5U (EIA)	50	22000pF ±20%	1.60	0.80	0.80
GRM216E41H473MA01	Z5U (EIA)	50	47000pF ±20%	2.00	1.25	0.60
GRM219E41H104MA01	Z5U (EIA)	50	0.10μF ±20%	2.00	1.25	0.85
GRM319E41H224MA01	Z5U (EIA)	50	0.22μF ±20%	3.20	1.60	0.85

**⚠ Note** • This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering. Especially, please read rating and **⚠ CAUTION** (for storage, operating, rating, soldering, mounting and handling) in them to prevent smoking and/or burning, etc.

• You are able to read a detailed specifications in the website (<http://search.murata.co.jp/>) before to require our product specifications or to transact the approval sheet for product specifications.

## ■ Specifications and Test Methods

No.	Item	Specifications		Test Method												
		Temperature Compensating Type	High Dielectric Type													
1	Operating Temperature Range	−55 to +125°C	B1, B3, F1 : −25°C to +85°C R1, R7 : −55°C to +125°C E4 : +10°C to +85°C F5 : −30°C to +85°C	Reference Temperature : 25°C (2Δ, 3Δ, 4Δ, B1, B3, F1, R1 : 20°C)												
2	Rated Voltage	See the previous pages		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.												
3	Appearance	No defects or abnormalities		Visual inspection												
4	Dimensions	Within the specified dimensions		Using calipers												
5	Dielectric Strength	No defects or abnormalities		No failure should be observed when 300% of the rated voltage (temperature compensating type) or 250% of the rated voltage (high dielectric constant type) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.												
6	Insulation Resistance	$C \leq 0.047\mu F$ : More than 10,000MΩ $C > 0.047\mu F$ : $500\Omega \bullet F$ C : Nominal Capacitance		The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20°C/25°C and 75%RH max. and within 2 minutes of charging, provided the charge/discharge current is less than 50mA.												
7	Capacitance	Within the specified tolerance		The capacitance/D.F. should be measured at 20°C/25°C at the frequency and voltage shown in the table.												
8	Q/ Dissipation Factor (D.F.)	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20C$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. ( $C < 3.3\mu F$ ) : 0.1max. ( $C \geq 3.3\mu F$ ) [F1, F5] W.V. : 25Vmin. : 0.05max. ( $C < 0.1\mu F$ ) : 0.09max. ( $C \geq 0.1\mu F$ ) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.	<table border="1"> <thead> <tr> <th>Char. Item</th> <th><math>\Delta C</math> to <math>\Delta U</math>, 1X (more than 1000pF and below) R6, R7, F5 B1, B3, F1</th> <th><math>\Delta C</math> to <math>\Delta U</math>, 1X (1000pF and below) E4</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td>1±0.1MHz</td> <td>1±0.1kHz</td> </tr> <tr> <td>Voltage</td> <td>0.5 to 5Vrms</td> <td>1±0.2Vrms</td> </tr> <tr> <td></td> <td>0.5±0.05Vrms</td> <td></td> </tr> </tbody> </table>	Char. Item	$\Delta C$ to $\Delta U$ , 1X (more than 1000pF and below) R6, R7, F5 B1, B3, F1	$\Delta C$ to $\Delta U$ , 1X (1000pF and below) E4	Frequency	1±0.1MHz	1±0.1kHz	Voltage	0.5 to 5Vrms	1±0.2Vrms		0.5±0.05Vrms	
Char. Item	$\Delta C$ to $\Delta U$ , 1X (more than 1000pF and below) R6, R7, F5 B1, B3, F1	$\Delta C$ to $\Delta U$ , 1X (1000pF and below) E4														
Frequency	1±0.1MHz	1±0.1kHz														
Voltage	0.5 to 5Vrms	1±0.2Vrms														
	0.5±0.05Vrms															

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No.	Item	Specifications		Test Method																																				
		Temperature Compensating Type	High Dielectric Type																																					
9	Capacitance Temperature Characteristics	No bias Within the specified tolerance (Table A-1)	B1, B3 : Within $\pm 10\%$ (-25°C to +85°C) R1, R7 : Within $\pm 15\%$ (-55°C to +125°C) R6 : Within $\pm 15\%$ (-55°C to +85°C) E4 : Within +22/-56% (+10°C to +85°C) F1 : Within +30/-80% (-25°C to +85°C) F5 : Within +22/-82% (-30°C to +85°C)	<p>The capacitance change should be measured after 5min. at each specified temp. stage.</p> <p>(1) Temperature Compensating Type</p> <p>The temperature coefficient is determined using the capacitance measured in step 3 as a reference.</p> <p>When cycling the temperature sequentially from step 1 through 5 (5°C : +25°C to +125°C/ΔC : +20°C to +125°C : other temp. coeffs. : +25°C to +85°C/+20°C to +85°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1.</p> <p>The capacitance drift is calculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3.</p>																																				
		50% of the Rated Voltage	B1 : Within +10/-30% R1 : Within +15/-40% F1 : Within +30/-95%																																					
		Capacitance Drift Within $\pm 0.2\%$ or $\pm 0.05\text{pF}$ (Whichever is larger.) *Not apply to 1X/25V	<p>*Initial measurement for high dielectric constant type</p> <p>Perform a heat treatment at 150+0/-10°C for one hour and then set for 48±4 hours at room temperature.</p> <p>Perform the initial measurement.</p>	<p>(2) High Dielectric Constant Type</p> <p>The ranges of capacitance change compared with the 20°C value over the temperature ranges shown in the table should be within the specified ranges.*</p> <p>In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Applying Voltage (V)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference Temperature<math>\pm 2</math></td> <td rowspan="3">No bias</td> </tr> <tr> <td>2</td> <td>-55<math>\pm 3</math> (for R1, R7, R6) -25<math>\pm 3</math> (for B1, B3, F1) -30<math>\pm 3</math> (for F5)/10<math>\pm 3</math> (for E4)</td> </tr> <tr> <td>3</td> <td>Reference Temperature<math>\pm 2</math></td> </tr> <tr> <td>4</td> <td>125<math>\pm 3</math> (for R1, R7)/ 85<math>\pm 3</math> (for B1, B3, R6 F1, F5, E4)</td> <td rowspan="5">50% of the rated voltage</td> </tr> <tr> <td>5</td> <td>Reference Temperature<math>\pm 2</math></td> </tr> <tr> <td>6</td> <td>-55<math>\pm 3</math> (for R1)/ -25<math>\pm 3</math> (for B1, F1)</td> </tr> <tr> <td>7</td> <td>Reference Temperature<math>\pm 2</math></td> </tr> <tr> <td>8</td> <td>125<math>\pm 3</math> (for R1)/ 85<math>\pm 3</math> (for B1, F1)</td> </tr> </tbody> </table>	Step	Temperature (°C)	Applying Voltage (V)	1	Reference Temperature $\pm 2$	No bias	2	-55 $\pm 3$ (for R1, R7, R6) -25 $\pm 3$ (for B1, B3, F1) -30 $\pm 3$ (for F5)/10 $\pm 3$ (for E4)	3	Reference Temperature $\pm 2$	4	125 $\pm 3$ (for R1, R7)/ 85 $\pm 3$ (for B1, B3, R6 F1, F5, E4)	50% of the rated voltage	5	Reference Temperature $\pm 2$	6	-55 $\pm 3$ (for R1)/ -25 $\pm 3$ (for B1, F1)	7	Reference Temperature $\pm 2$	8	125 $\pm 3$ (for R1)/ 85 $\pm 3$ (for B1, F1)															
Step	Temperature (°C)	Applying Voltage (V)																																						
1	Reference Temperature $\pm 2$	No bias																																						
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7	Reference Temperature $\pm 2$																																							
8	125 $\pm 3$ (for R1)/ 85 $\pm 3$ (for B1, F1)																																							
10	Adhesive Strength of Termination	No removal of the terminations or other defect should occur		<p>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec.</p> <p>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <p>*2N (GR□03), 5N (GR□15, GRM18)</p> <p>(in mm)</p> <table border="1"> <thead> <tr> <th>Type</th> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>GR□03</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>GR□15</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>GRM18</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>GRM21</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>GRM31</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> <tr> <td>GRM32</td> <td>2.2</td> <td>5.0</td> <td>2.9</td> </tr> <tr> <td>GRM43</td> <td>3.5</td> <td>7.0</td> <td>3.7</td> </tr> <tr> <td>GRM55</td> <td>4.5</td> <td>8.0</td> <td>5.6</td> </tr> </tbody> </table>	Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
Type	a	b	c																																					
GR□03	0.3	0.9	0.3																																					
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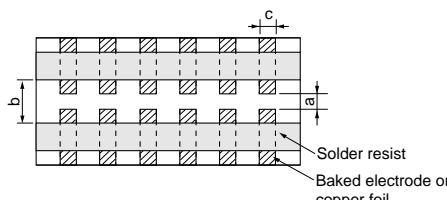


Fig. 1a

Continued from the preceding page.

No.	Item	Specifications		Test Method
		Temperature Compensating Type	High Dielectric Type	
11	Vibration Resistance	Appearance	No defects or abnormalities	Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).
		Capacitance	Within the specified tolerance	
		Q/D.F.	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20C$ C : Nominal Capacitance (pF)	
12	Deflection		No crack or marked defect should occur	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for $5 \pm 1$ sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.
			Fig. 3a	
13	Solderability of Termination			Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for $2 \pm 0.5$ seconds at $230 \pm 5^\circ\text{C}$ .
		The measured and observed characteristics should satisfy the specifications in the following table		
14	Resistance to Soldering Heat	Appearance	No defects or abnormalities	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder solution at $270 \pm 5^\circ\text{C}$ for $10 \pm 0.5$ seconds. Set at room temperature for $24 \pm 2$ hours (temperature compensating type) or $48 \pm 4$ hours (high dielectric constant type), then measure.
		Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)	
		Q/D.F.	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20C$ C : Nominal Capacitance (pF)	
		I.R.	More than $10,000\text{M}\Omega$ or $500\Omega \cdot \text{F}$ (Whichever is smaller)	
		Dielectric Strength	No defects	

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No.	Item	Specifications		Test Method	
		Temperature Compensating Type	High Dielectric Type		
15	Temperature Cycle	The measured and observed characteristics should satisfy the specifications in the following table			
		Appearance	No defects or abnormalities		
		Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)	B1, B3, R1, R6, R7 : Within $\pm 7.5\%$ F1, F5, E4 : Within $\pm 20\%$	
		Q/D.F.	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20\text{C}$	[B1, B3, R1, R6, R7, E4] W.V. : 25V/min. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. ( $C < 3.3\mu\text{F}$ ) : 0.1max. ( $C \geq 3.3\mu\text{F}$ )	
			C : Nominal Capacitance (pF)	[F1, F5] W.V. : 25V/min. : 0.05max. ( $C < 0.1\mu\text{F}$ ) : 0.09max. ( $C \geq 0.1\mu\text{F}$ ) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.	
		I.R.	More than $10,000\text{M}\Omega$ or $500\Omega \cdot \text{F}$ (Whichever is smaller)		
		Dielectric Strength	No defects		
16	Humidity (Steady State)	The measured and observed characteristics should satisfy the specifications in the following table			
		Appearance	No defects or abnormalities		
		Capacitance Change	Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within $\pm 12.5\%$ F1, F5 : Within $\pm 30\%$	
		Q/D.F.	30pF and over : $Q \geq 350$ 10pF and over 30pF and below : $Q \geq 275+2.5\text{C}$ 10pF and below : $Q \geq 200+10\text{C}$	[B1, B3, R1, R6, R7, E4] W.V. : 25V/min. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V/4V : 0.075max. ( $C < 3.3\mu\text{F}$ ) : 0.125max. ( $C \geq 3.3\mu\text{F}$ )	
			C : Nominal Capacitance (pF)	[F1, F5] W.V. : 25V/min. : 0.075max. ( $C < 0.1\mu\text{F}$ ) : 0.125max. ( $C \geq 0.1\mu\text{F}$ ) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.	
		I.R.	More than $1,000\text{M}\Omega$ or $50\Omega \cdot \text{F}$ (Whichever is smaller)		

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No.	Item	Specifications		Test Method	
		Temperature Compensating Type	High Dielectric Type		
17	Humidity Load	The measured and observed characteristics should satisfy the specifications in the following table			
		Appearance	No defects or abnormalities		
		Capacitance Change	Within $\pm 7.5\%$ or $\pm 0.75\text{pF}$ (Whichever is larger)	B1, B3, R1, R6, R7 : Within $\pm 12.5\%$ F1, F5, E4 : Within $\pm 30\%$ [W.V. : 10Vmax.] F1, F5 : Within $+30\%-40\%$	
		Q/D.F.	30pF and over : $Q \geq 200$ 30pF and below : $Q \geq 100+10C/3$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V : 0.075max. ( $C < 3.3\mu\text{F}$ ) : 0.125max. ( $C \geq 3.3\mu\text{F}$ ) [F1, F5] W.V. : 25Vmin. : 0.075max. ( $C < 0.1\mu\text{F}$ ) : 0.125max. ( $C \geq 0.1\mu\text{F}$ ) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.	
		I.R.	More than $500\text{M}\Omega$ or $25\Omega \cdot \text{F}$ (Whichever is smaller)		
18	High Temperature Load	The measured and observed characteristics should satisfy the specifications in the following table			
		Appearance	No defects or abnormalities		
		Capacitance Change	Within $\pm 3\%$ or $\pm 0.3\text{pF}$ (Whichever is larger)	B1, B3, R1, R6, R7 : Within $\pm 12.5\%$ F1, F5, E4 : Within $\pm 30\%$ [Exempt 10Vmax. and. $C \geq 1.0\mu\text{F}$ ] F1, F5 : Within $+30\%-40\%$ [10Vmax. and. $C \geq 1.0\mu\text{F}$ ]	
		Q/D.F.	30pF and over : $Q \geq 350$ 10pF and over 30pF and below : $Q \geq 275+2.5C$ 10pF and below : $Q \geq 200+10C$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.04max. W.V. : 16/10V : 0.05max. W.V. : 6.3V : 0.075max. ( $C < 3.3\mu\text{F}$ ) : 0.125max. ( $C \geq 3.3\mu\text{F}$ ) [F1, F5] W.V. : 25Vmin. : 0.075max. ( $C < 0.1\mu\text{F}$ ) : 0.125max. ( $C \geq 0.1\mu\text{F}$ ) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.	
		I.R.	More than $1,000\text{M}\Omega$ or $50\Omega \cdot \text{F}$ (Whichever is smaller)		

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Table A-1

(1)

Char.	Nominal Values (ppm/°C)*1	Capacitance Change from 25°C (%)					
		-55		-30		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
6C	0± 60	0.87	-0.48	0.59	-0.33	0.38	-0.21
6P	-150± 60	2.33	0.72	1.61	0.50	1.02	0.32
6R	-220± 60	3.02	1.28	2.08	0.88	1.32	0.56
6S	-330± 60	4.09	2.16	2.81	1.49	1.79	0.95
6T	-470± 60	5.46	3.28	3.75	2.26	2.39	1.44
7U	-750±120	8.78	5.04	6.04	3.47	3.84	2.21
1X	+350 to -1000	-	-	-	-	-	-

\*1Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for  $\Delta C$ )/85°C (for other TC).

(2)

Char.	Nominal Values (ppm/°C)*2	Capacitance Change from 20°C (%)					
		-55		-25		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
2C	0± 60	0.82	-0.45	0.49	-0.27	0.33	-0.18
3C	0±120	1.37	-0.90	0.82	-0.54	0.55	-0.36
4C	0±250	2.56	-1.88	1.54	-1.13	1.02	-0.75
2P	-150± 60	-	-	1.32	0.41	0.88	0.27
3P	-150±120	-	-	1.65	0.14	1.10	0.09
4P	-150±250	-	-	2.36	-0.45	1.57	-0.30
2R	-220± 60	-	-	1.70	0.72	1.13	0.48
3R	-220±120	-	-	2.03	0.45	1.35	0.30
4R	-220±250	-	-	2.74	-0.14	1.83	-0.09
2S	-330± 60	-	-	2.30	1.22	1.54	0.81
3S	-330±120	-	-	2.63	0.95	1.76	0.63
4S	-330±250	-	-	3.35	0.36	2.23	0.24
2T	-470± 60	-	-	3.07	1.85	2.05	1.23
3T	-470±120	-	-	3.40	1.58	2.27	1.05
4T	-470±250	-	-	4.12	0.99	2.74	0.66
3U	-750±120	-	-	4.94	2.84	3.29	1.89
4U	-750±250	-	-	5.65	2.25	3.77	1.50

\*2Nominal values denote the temperature coefficient within a range of 20°C to 125°C (for  $\Delta C$ )/85°C (for other TC).

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## Monolithic Ceramic Capacitors GR\_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

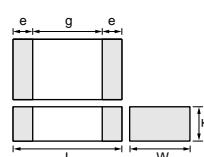
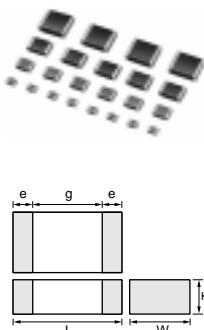
High Dielectric Constant Type 100V

Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
<b>GRM188R72A222KA01</b>	X7R (EIA)	100	2200pF ±10%	1.60	0.80	0.80
<b>GRM188R72A332KA01</b>	X7R (EIA)	100	3300pF ±10%	1.60	0.80	0.80
<b>GRM188F52A472ZD01</b>	Y5V (EIA)	100	4700pF +80/-20%	1.60	0.80	0.80
<b>GRM219R72A472KA01</b>	X7R (EIA)	100	4700pF ±10%	2.00	1.25	0.85
<b>GRM219R72A682KA01</b>	X7R (EIA)	100	6800pF ±10%	2.00	1.25	0.85
<b>GRM21BR72A103KA01</b>	X7R (EIA)	100	10000pF ±10%	2.00	1.25	1.25
<b>GRM31MR72A333KA01</b>	X7R (EIA)	100	33000pF ±10%	3.20	1.60	1.15
<b>GRM31MR72A473KA01</b>	X7R (EIA)	100	47000pF ±10%	3.20	1.60	1.15
<b>GRM32ER72A105KA01</b>	X7R (EIA)	100	1.0μF ±10%	3.20	2.50	2.50
<b>GRM32NR72A683KA01</b>	X7R (EIA)	100	68000pF ±10%	3.20	2.50	1.35
<b>GRM32NF52A104ZA01</b>	Y5V (EIA)	100	0.10μF +80/-20%	3.20	2.50	1.35
<b>GRM32NR72A104KA01</b>	X7R (EIA)	100	0.10μF ±10%	3.20	2.50	1.35
<b>GRM43DR72A474KA01</b>	X7R (EIA)	100	0.47μF ±10%	4.50	3.20	2.00
<b>GRM43ER72A225KA01</b>	X7R (EIA)	100	2.2μF ±10%	4.50	3.20	2.50
<b>GRM43RR72A154KA01</b>	X7R (EIA)	100	0.15μF ±10%	4.50	3.20	1.80
<b>GRM43RR72A224KA01</b>	X7R (EIA)	100	0.22μF ±10%	4.50	3.20	1.80
<b>GRM55DR72A105KA01</b>	X7R (EIA)	100	1.0μF ±10%	5.70	5.00	2.00
<b>GRM55ER72A475KA01</b>	X7R (EIA)	100	4.7μF ±10%	5.70	5.00	2.50
<b>GRM55RF52A474ZA01</b>	Y5V (EIA)	100	0.47μF +80/-20%	5.70	5.00	1.80

## Monolithic Ceramic Capacitors GR\_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

Thin Layer Large-Capacitance type

Part Number	Dimensions (mm)			
	L	W	T	e min. g min.
<b>GRM033</b>	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2 0.2
<b>GRM155</b>	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3 0.4
<b>GRM185</b>	1.6 ±0.1	0.8 ±0.1	0.5 ±0.1	0.2 to 0.5 0.5
<b>GRM188</b>	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5 0.5
<b>GRM216</b>		0.6 ±0.1		
<b>GRM219</b>	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7 0.7
<b>GRM21B</b>		1.25 ±0.1		
<b>GRM316</b>		0.6 ±0.1		
<b>GRM319</b>	3.2 ±0.15	1.6 ±0.15	0.85 ±0.1	0.3 to 0.8 1.5
<b>GRM31M</b>		1.15 ±0.1		
<b>GRM31C</b>	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2	
<b>GRM32C</b>		1.6 ±0.2		
<b>GRM32D</b>	3.2 ±0.3	2.5 ±0.2	2.0 ±0.2	0.3 1.0
<b>GRM32E</b>		2.5 ±0.2		
<b>GRM43D</b>	4.5 ±0.4	3.2 ±0.3	2.0 ±0.2	0.3 2.0
<b>GRM43E</b>		2.5 ±0.2		
<b>GRM43S</b>		2.8 ±0.2		
<b>GRM55F</b>	5.7 ±0.4	5.0 ±0.4	3.2 ±0.2	0.3 2.0



Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
<b>GRM033R60J153KE01</b>	X5R (EIA)	6.3	15000pF ±10%	0.6	0.3	0.3
<b>GRM033R60J223KE01</b>	X5R (EIA)	6.3	22000pF ±10%	0.6	0.3	0.3
<b>GRM033R60J333KE01</b>	X5R (EIA)	6.3	33000pF ±10%	0.6	0.3	0.3
<b>GRM033R60J393KE19</b>	X5R (EIA)	6.3	39000pF ±10%	0.6	0.3	0.3
<b>GRM033R60J473KE19</b>	X5R (EIA)	6.3	47000pF ±10%	0.6	0.3	0.3
<b>GRM033R60J104KE19</b>	X5R (EIA)	6.3	0.10μF ±10%	0.6	0.3	0.3
<b>GRM155R60J154KE01</b>	X5R (EIA)	6.3	0.15μF ±10%	1.00	0.50	0.50
<b>GRM155R60J224KE01</b>	X5R (EIA)	6.3	0.22μF ±10%	1.00	0.50	0.50
<b>GRM155R60J334KE01</b>	X5R (EIA)	6.3	0.33μF ±10%	1.00	0.50	0.50
<b>GRM155R60J474KE19</b>	X5R (EIA)	6.3	0.47μF ±10%	1.00	0.50	0.50
<b>GRM155R60J105KE19</b>	X5R (EIA)	6.3	1.0μF ±10%	1.00	0.50	0.50
<b>GRM185R60J105KE21</b>	X5R (EIA)	6.3	1.0μF ±10%	1.60	0.80	0.50
<b>GRM185R60J105KE26</b>	X5R (EIA)	6.3	1.0μF ±10%	1.60	0.80	0.50

Continued on the following page. 

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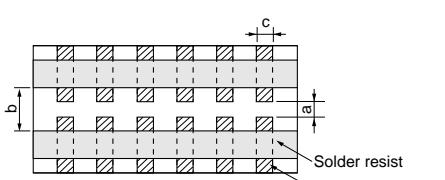
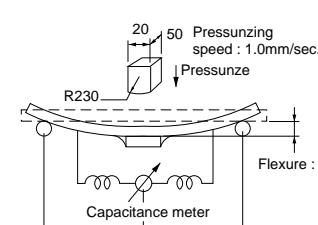
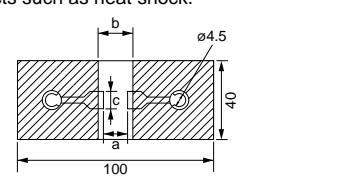
Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
<b>GRM185R60J225KE26</b>	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.50
<b>GRM188R60J225KE01</b>	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.80
<b>GRM188R60J225KE19</b>	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.80
<b>GRM188R60J475KE19</b>	X5R (EIA)	6.3	4.7μF ±10%	1.60	0.80	0.80
<b>GRM219R60J475KE01</b>	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
<b>GRM219R60J475KE19</b>	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
<b>GRM219R60J475KE32</b>	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
<b>GRM219R60J106KE19</b>	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	0.85
<b>GRM219R60J106ME19</b>	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	0.85
<b>GRM21BR60J106KE01</b>	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	1.25
<b>GRM21BR60J106KE19</b>	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	1.25
<b>GRM21BR60J106ME01</b>	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	1.25
<b>GRM21BR60J106ME19</b>	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	1.25
<b>GRM21BR60J226ME39</b>	X5R (EIA)	6.3	22μF ±20%	2.00	1.25	1.25
<b>GRM319R60J106KE01</b>	X5R (EIA)	6.3	10μF ±10%	3.20	0.85	1.60
<b>GRM31CR60J156KE19</b>	X5R (EIA)	6.3	15μF ±10%	3.20	1.60	1.60
<b>GRM31CR60J226KE19</b>	X5R (EIA)	6.3	22μF ±10%	3.20	1.60	1.60
<b>GRM31CR60J226ME19</b>	X5R (EIA)	6.3	22μF ±20%	3.20	1.60	1.60
<b>GRM32DR60J226KA01</b>	X5R (EIA)	6.3	22μF ±10%	3.20	2.50	2.00
<b>GRM32DR60J336ME19</b>	X5R (EIA)	6.3	33μF ±10%	3.20	2.50	2.00
<b>GRM32ER60J476ME20</b>	X5R (EIA)	6.3	47μF ±20%	3.20	2.50	2.50
<b>GRM32ER60J107ME20</b>	X5R (EIA)	6.3	100μF ±20%	3.20	2.50	2.50
<b>GRM43DR60J336KE01</b>	X5R (EIA)	6.3	33μF ±10%	4.50	3.20	2.00
<b>GRM43ER60J476KE01</b>	X5R (EIA)	6.3	47μF ±10%	4.50	3.20	2.50
<b>GRM43SR60J107ME20</b>	X5R (EIA)	6.3	100μF ±20%	4.50	3.20	2.80
<b>GRM155F50J105ZE01</b>	Y5V (EIA)	6.3	1.0μF +80/-20%	1.00	0.50	0.50
<b>GRM188F50J225ZE01</b>	Y5V (EIA)	6.3	2.2μF +80/-20%	1.60	0.80	0.80
<b>GRM188F50J475ZE20</b>	Y5V (EIA)	6.3	4.7μF +80/-20%	1.60	0.80	0.80
<b>GRM21BF50J106ZE01</b>	Y5V (EIA)	6.3	10μF +80/-20%	2.00	1.25	1.25
<b>GRM31CF50J226ZE01</b>	Y5V (EIA)	6.3	22μF +80/-20%	3.20	1.60	1.60
<b>GRM32EF50J107ZE20</b>	Y5V (EIA)	6.3	100μF +80/-20%	3.20	2.50	2.50

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No.	Item	Specifications	Test Method																											
1	Operating Temperature Range	B1, B3, F1 : -25°C to +85°C R6 : -55°C to +85°C F5 : -30°C to +85°C C8 : -55°C to +105°C, C7 : -55°C to +125°C	Reference Temperature : 25°C (B1, B3, F1 : 20°C)																											
2	Rated Voltage	See the previous pages	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, $V^{P-P}$ or $V^{O-P}$ , whichever is larger, should be maintained within the rated voltage range.																											
3	Appearance	No defects or abnormalities	Visual inspection																											
4	Dimensions	Within the specified dimensions	Using calipers																											
5	Dielectric Strength	No defects or abnormalities	No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																											
6	Insulation Resistance	More than $50\Omega \cdot F$	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at Reference Temperature and 75%RH max. and within 1 minutes of charging, provided the charge/discharge current is less than 50mA.																											
7	Capacitance	Within the specified tolerance  *Table 1 <u>GRM155 B3/R6 1A 124 to 224</u> <u>GRM185 B3/R6 1A 105</u> <u>GRM188 B3/R6 1C/1A 225</u> <u>GRM219 B3/R6 1A 475</u> <u>GRM21B B3/R6 1C/1A 106</u>	The capacitance should be measured at Reference Temperature at the frequency and voltage shown in the table.  <table border="1"><thead><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr></thead><tbody><tr><td><math>C \leq 10\mu F</math> (10V min.)<sup>*1</sup></td><td><math>1 \pm 0.1\text{kHz}</math></td><td><math>1.0 \pm 0.2\text{VRms}</math></td></tr><tr><td><math>C \leq 10\mu F</math> (6.3V max.)</td><td><math>1 \pm 0.1\text{kHz}</math></td><td><math>0.5 \pm 0.1\text{VRms}</math></td></tr><tr><td><math>C &gt; 10\mu F</math></td><td><math>120 \pm 24\text{Hz}</math></td><td><math>0.5 \pm 0.1\text{VRms}</math></td></tr></tbody></table> *1 However the Voltage is $0.5 \pm 0.1\text{VRms}$ about Table 1 items on the left side.	Capacitance	Frequency	Voltage	$C \leq 10\mu F$ (10V min.) <sup>*1</sup>	$1 \pm 0.1\text{kHz}$	$1.0 \pm 0.2\text{VRms}$	$C \leq 10\mu F$ (6.3V max.)	$1 \pm 0.1\text{kHz}$	$0.5 \pm 0.1\text{VRms}$	$C > 10\mu F$	$120 \pm 24\text{Hz}$	$0.5 \pm 0.1\text{VRms}$															
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$C > 10\mu F$	$120 \pm 24\text{Hz}$	$0.5 \pm 0.1\text{VRms}$																												
8	Dissipation Factor (D.F.)	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.  *Table 1 <u>GRM155 B3/R6 1A 124 to 224</u> <u>GRM185 B3/R6 1A 105</u> <u>GRM188 B3/R6 1C/1A 225</u> <u>GRM219 B3/R6 1A 475</u> <u>GRM21B B3/R6 1C/1A 106</u>	The D.F. should be measured at Reference Temperature at the frequency and voltage shown in the table.  <table border="1"><thead><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr></thead><tbody><tr><td><math>C \leq 10\mu F</math> (10V min.)<sup>*1</sup></td><td><math>1 \pm 0.1\text{kHz}</math></td><td><math>1.0 \pm 0.2\text{VRms}</math></td></tr><tr><td><math>C \leq 10\mu F</math> (6.3V max.)</td><td><math>1 \pm 0.1\text{kHz}</math></td><td><math>0.5 \pm 0.1\text{VRms}</math></td></tr><tr><td><math>C &gt; 10\mu F</math></td><td><math>120 \pm 24\text{Hz}</math></td><td><math>0.5 \pm 0.1\text{VRms}</math></td></tr></tbody></table> *1 However the Voltage is $0.5 \pm 0.1\text{VRms}$ about Table 1 items on the left side.	Capacitance	Frequency	Voltage	$C \leq 10\mu F$ (10V min.) <sup>*1</sup>	$1 \pm 0.1\text{kHz}$	$1.0 \pm 0.2\text{VRms}$	$C \leq 10\mu F$ (6.3V max.)	$1 \pm 0.1\text{kHz}$	$0.5 \pm 0.1\text{VRms}$	$C > 10\mu F$	$120 \pm 24\text{Hz}$	$0.5 \pm 0.1\text{VRms}$															
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$C \leq 10\mu F$ (6.3V max.)	$1 \pm 0.1\text{kHz}$	$0.5 \pm 0.1\text{VRms}$																												
$C > 10\mu F$	$120 \pm 24\text{Hz}$	$0.5 \pm 0.1\text{VRms}$																												
9	Capacitance Temperature Characteristics	No bias  B1, B3 : Within $\pm 10\%$ (-25°C to +85°C) F1 : Within $\pm 30\%$ (-25°C to +85°C) R6 : Within $\pm 15\%$ (-55°C to +85°C) F5 : Within $\pm 22\%$ (-30°C to +85°C) C7 : Within $\pm 22\%$ (-55°C to +125°C) C8 : Within $\pm 22\%$ (-55°C to +105°C)  50% of the Rated Voltage  B1: Within $\pm 10\%$ F1: Within $\pm 30\%$	The capacitance change should be measured after 5min. at each specified temp. stage. The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.  *GRM43 B1/R6 0J/1A 336/476 only : $1.0 \pm 0.2\text{VRms}$ <table border="1"><thead><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr></thead><tbody><tr><td>1</td><td>Reference Tempererature <math>\pm 2</math></td><td></td></tr><tr><td>2</td><td>-55 <math>\pm 3</math> (for R6, C7, C8)/ -25 <math>\pm 3</math> (for B1, B3, F1) -30 <math>\pm 3</math> (for F5)</td><td></td></tr><tr><td>3</td><td>Reference Tempererature <math>\pm 2</math></td><td></td></tr><tr><td>4</td><td>85 <math>\pm 3</math> (for B1, B3, F1, R6, F5) 125 <math>\pm 3</math> (for C7)/ 105 <math>\pm 3</math> (for C8)/</td><td></td></tr><tr><td>5</td><td>20 <math>\pm 2</math></td><td></td></tr><tr><td>6</td><td>-25 <math>\pm 3</math> (for B1, F1)</td><td></td></tr><tr><td>7</td><td>20 <math>\pm 2</math></td><td></td></tr><tr><td>8</td><td>85 <math>\pm 3</math> (for B1, F1)</td><td></td></tr></tbody></table> *Initial measurement for high dielectric constant type Perform a heat treatment at $150 \pm 10^\circ\text{C}$ for one hour and then set for $48 \pm 4$ hours at room temperature. Perform the initial measurement. No bias 50% of the rated voltage	Step	Temperature (°C)	Applying Voltage (V)	1	Reference Tempererature $\pm 2$		2	-55 $\pm 3$ (for R6, C7, C8)/ -25 $\pm 3$ (for B1, B3, F1) -30 $\pm 3$ (for F5)		3	Reference Tempererature $\pm 2$		4	85 $\pm 3$ (for B1, B3, F1, R6, F5) 125 $\pm 3$ (for C7)/ 105 $\pm 3$ (for C8)/		5	20 $\pm 2$		6	-25 $\pm 3$ (for B1, F1)		7	20 $\pm 2$		8	85 $\pm 3$ (for B1, F1)	
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No.	Item	Specifications	Test Method																																				
10	Adhesive Strength of Termination	No removal of the terminations or other defects should occur   Fig. 1a	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10+/-1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock. *5N : GR□15/GRM18, 2N : GR□33 <table border="1" data-bbox="922 381 1431 583"> <thead> <tr> <th>Type</th><th>a</th><th>b</th><th>c</th></tr> </thead> <tbody> <tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr> <tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr> <tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr> <tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr> <tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr> <tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr> <tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr> <tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr> </tbody> </table>	Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
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11	Vibration	<table border="1" data-bbox="238 606 890 673"> <tr> <td>Appearance</td><td>No defects or abnormalities</td></tr> <tr> <td>Capacitance</td><td>Within the specified tolerance</td></tr> </table> <p>D.F.</p> <p>B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.</p>	Appearance	No defects or abnormalities	Capacitance	Within the specified tolerance	Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).																																
Appearance	No defects or abnormalities																																						
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12	Deflection	<p>No cracking or marking defects should occur</p>  Fig. 3a	Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5+/-1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.   Fig. 2a (GR□03, GR□15 : t : 0.8mm) <table border="1" data-bbox="922 1257 1431 1482"> <thead> <tr> <th>Type</th><th>a</th><th>b</th><th>c</th></tr> </thead> <tbody> <tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr> <tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr> <tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr> <tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr> <tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr> <tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr> <tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr> <tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr> </tbody> </table> <p>(in mm)</p>	Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
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13	Solderability of Termination	75% of the terminations is to be soldered evenly and continuously	Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion). Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2+/-0.5 seconds at 230+/-5°C.																																				

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No.	Item	Specifications	Test Method															
14	Appearance	No defects or abnormalities	<p>Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder solution at 270+/-5°C for 10+/-0.5 seconds. Set at room temperature for 24+/-2 hours (temperature compensating type) or 48+/-4 hours (high dielectric constant type), then measure.</p> <ul style="list-style-type: none"> <li>Initial measurement for high dielectric constant type</li> </ul> <p>Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 48+/-4 hours. Perform the initial measurement.</p> <p>*Preheating for GRM32/43/55</p> <table border="1"> <thead> <tr> <th>Step</th><th>Temperature</th><th>Time</th></tr> </thead> <tbody> <tr> <td>1</td><td>100°C to 120°C</td><td>1 min.</td></tr> <tr> <td>2</td><td>170°C to 200°C</td><td>1 min.</td></tr> </tbody> </table>	Step	Temperature	Time	1	100°C to 120°C	1 min.	2	170°C to 200°C	1 min.						
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Q/D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.																	
I.R.	More than 50Ω • F																	
Dielectric Strength	No defects																	
15	Appearance	No defects or abnormalities	<p>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table.</p> <p>Set for 24+/-2 hours (temperature compensating type) or 48+/-4 hours (high dielectric constant type) at room temperature, then measure.</p> <table border="1"> <thead> <tr> <th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr> <tr> <th>Temp. (°C)</th><th>Min. Operating Temp. +0/-3</th><th>Room Temp.</th><th>Max. Operating Temp. +3/-0</th><th>Room Temp.</th></tr> </thead> <tbody> <tr> <td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr> </tbody> </table> <ul style="list-style-type: none"> <li>Initial measurement for high dielectric constant type</li> </ul> <p>Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 48+/-4 hours. Perform the initial measurement.</p>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp. +0/-3	Room Temp.	Max. Operating Temp. +3/-0	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
Step	1	2	3	4														
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I.R.	More than 50Ω • F																	
Dielectric Strength	No defects																	
16	Appearance	No defects or abnormalities	<p>Apply the rated voltage at 40+/-2°C and 90 to 95% humidity for 500+/-12 hours. The charge/discharge current is less than 50mA.</p> <ul style="list-style-type: none"> <li>Initial measurement</li> </ul> <p>Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature. Perform the initial measurement.</p> <ul style="list-style-type: none"> <li>Measurement after test</li> </ul> <p>Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature, then measure.</p>															
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	I.R.	More than 12.5Ω • F																
17	Appearance	No defects or abnormalities	<p>Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C. Let sit for 48+/-4 hours at room temperature, then measure.</p> <p>The charge/ discharge current is less than 50mA.</p> <ul style="list-style-type: none"> <li>Initial measurement</li> </ul> <p>Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature. Perform the initial measurement.</p> <ul style="list-style-type: none"> <li>Measurement after test</li> </ul> <p>Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature, then measure.</p>															
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	D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.4 max.																
	I.R.	More than 25Ω • F																

**⚠ Note** • This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering. Especially, please read rating and **⚠ CAUTION** (for storage, operating, rating, soldering, mounting and handling) in them to prevent smoking and/or burning, etc.

• You are able to read a detailed specifications in the website (<http://search.murata.co.jp/>) before to require our product specifications or to transact the approval sheet for product specifications.